

Claims

[c1] **WHAT IS CLAIMED:**

1.A weight-on-bit measurement tool, comprising:
a body;
at least one strain gauge cavity in said body, said strain
gauge cavity having a strain gauge mounting surface
that is located at a position such that a region of ap-
proximately zero axial strain due to downhole pressures
during drilling operations exists on said mounting sur-
face when said tool is subjected to said downhole pres-
sures during drilling operations; and
a weight-on-bit strain gauge operatively coupled to said
mounting face above said region of approximately zero
axial strain.

[c2] 2.The tool of claim 1, further comprising a cover plate
positioned in an opening of said cavity.

[c3] 3.The tool of claim 2, wherein said cover plate and said
cavity define a chamber substantially free of liquids.

[c4] 4.The tool of claim 2, wherein said cavity defines a space
that is filled with a liquid.

- [c5] 5.The tool of claim 1, wherein said cavity has a circular cross-sectional configuration.
- [c6] 6.The tool of claim 1, wherein said tool is comprised of at least one of stainless steel, a carbon steel and titanium.
- [c7] 7.The tool of claim 1, wherein said cavity has a circular cross-sectional configuration of a diameter of approximately 1-1/2" and said mounting face is positioned at a depth of approximately 1-1/8" below an outer surface of said body.
- [c8] 8.The tool of claim 1, wherein said cavity is formed in said body.
- [c9] 9.The tool of claim 1, wherein said cavity is defined, at least partially, by a cavity insert positioned in said body.
- [c10] 10.The tool of claim 9, further comprising an internal passageway formed between an internal bore of said body and said cavity insert.
- [c11] 11.The tool of claim 9, wherein at least a portion of said cavity insert has a conical configuration.
- [c12] 12.A weight-on-bit measurement tool, comprising:
 - a body;
 - at least two strain gauge cavities in said body, each of

said strain gauge cavities having a strain gauge mounting surface that is located at a position such that a region of approximately zero axial strain due to downhole pressures during drilling operations exists on said mounting surface when said tool is subjected to said downhole pressures during drilling operations; and a weight-on-bit strain gauge operatively coupled to said mounting face above said region of approximately zero axial strain.

- [c13] 13.The tool of claim 12, wherein said cavities are positioned on opposite sides of said tool body.
- [c14] 14.The tool of claim 12, further comprising a cover plate positioned in an opening of each of said cavities.
- [c15] 15.The tool of claim 14, wherein said cover plate and said cavity define a chamber substantially free of liquids.
- [c16] 16.The tool` of claim 14, wherein said cavity defines a space that is filled with a liquid.
- [c17] 17.The tool of claim 12, wherein said cavity has a circular cross-sectional configuration.
- [c18] 18.The tool of claim 12, wherein said tool is comprised of at least one of stainless steel, a carbon steel and titanium.

- [c19] 19.The tool of claim 12, wherein said cavity has a circular cross-sectional configuration of a diameter of approximately 1-1/2" and said mounting face is positioned at a depth of approximately 1-1/8" below an outer surface of said body.
- [c20] 20.The tool of claim 12, wherein said cavity is formed in said body.
- [c21] 21.The tool of claim 12, wherein said cavity is defined, at least partially, by a cavity insert positioned in said body.
- [c22] 22.The tool of claim 21, further comprising an internal passageway formed between an internal bore of said body and said cavity insert.
- [c23] 23.The tool of claim 21, wherein at least a portion of said cavity insert has a conical configuration.
- [c24] 24.A method, comprising:
 - providing a weight-on-bit measurement tool comprised of:
 - a body;
 - at least one strain gauge cavity in said body, said strain gauge cavity having a strain gauge mounting surface that is located at a position such that a region of approximately zero axial strain due to downhole pressures

during drilling operations exists on said mounting surface when said tool is subjected to said downhole pressures during drilling operations; and
a weight-on-bit strain gauge operatively coupled to said mounting face above said region of approximately zero axial strain;
positioning said tool in a drill string comprised of a drill bit;
drilling a well bore with said drill string; and
obtaining weight-on-bit measurement data using said weight-on-bit strain gauge in said tool.

- [c25] 25.The method of claim 24, wherein said weight-on-bit measurement data is provided on a real-time basis.
- [c26] 26.The method of claim 24, wherein said weight-on-bit measurement data is provided on a non-real-time basis.
- [c27] 27.The method of claim 24, further comprising a cover plate positioned in an opening of said cavity.
- [c28] 28.The method of claim 27, wherein said cover plate and said cavity define a chamber substantially free of liquids.
- [c29] 29.The method of claim 27, wherein said cavity defines a space that is filled with a liquid.
- [c30] 30.The method of claim 24, wherein said cavity has a

circular cross-sectional configuration.

- [c31] 31.The method of claim 24, wherein said tool is comprised of at least one of stainless steel, a carbon steel and titanium.
- [c32] 32.The method of claim 24, wherein said cavity has a circular cross-sectional configuration of a diameter of approximately 1-1/2" and said mounting face is positioned at a depth of approximately 1-1/8" below an outer surface of said body.
- [c33] 33.The method of claim 24, wherein said cavity is formed in said body.
- [c34] 34.The method of claim 24, wherein said cavity is defined, at least partially, by a cavity insert positioned in said body.
- [c35] 35.The method of claim 34, further comprising an internal passageway formed between an internal bore of said body and said cavity insert.
- [c36] 36.The method of claim 34, wherein at least a portion of said cavity insert has a conical configuration.
- [c37] 37.A method, comprising:
identifying a region of approximately zero axial strain due to downhole pressures for a body to be positioned

in a drill string when said body is subjected to downhole pressures during drilling operations; providing a strain gauge cavity in said body such that a strain gauge mounting face within said cavity is located at a position wherein said region of approximately zero axial strain exists on said mounting face when said body is subjected to said downhole pressures during said drilling operations; and coupling a weight-on-bit strain gauge to said mounting face above said region of approximately zero axial strain.

- [c38] 38.The method of claim 37, wherein providing a strain gauge cavity in said body comprises machining a cavity in said body.
- [c39] 39.The method of claim 37, wherein providing a strain gauge cavity in said body comprises forming an opening in said body and positioning a cavity insert in said opening.
- [c40] 40.The method of claim 37, further comprising a cover plate positioned in an opening of said cavity.
- [c41] 41.The method of claim 37, wherein said cover plate and said cavity define a chamber substantially free of liquids.
- [c42] 42.The method of claim 37, wherein said cavity defines a

space that is filled with a liquid.

- [c43] 43.The method of claim 37, wherein said cavity has a circular cross-sectional configuration.
- [c44] 44.The method of claim 37, wherein said tool is comprised of at least one of stainless steel, a carbon steel and titanium.
- [c45] 45.The method of claim 37, wherein said cavity has a circular cross-sectional configuration of a diameter of approximately 1-1/2" and said mounting face is positioned at a depth of approximately 1-1/8" below an outer surface of said body.
- [c46] 46.The method of claim 37, wherein said cavity is formed in said body.
- [c47] 47.The method of claim 37, wherein said cavity is defined, at least partially, by a cavity insert positioned in said body.
- [c48] 48.The method of claim 47, further comprising an internal passageway formed between an internal bore of said body and said cavity insert.
- [c49] 49.The method of claim 47, wherein at least a portion of said cavity insert has a conical configuration.